

## CRYSTALLIZED BOTTLENECK OF POLYESTER BEER BOTTLE AND MANUFACTURING METHOD FOR THE SAME

### BACKGROUND OF THE INVENTION

#### 5 1. Field of the Invention

The invention relates to a container for receiving liquid, more specifically, to a crystallized bottleneck of polyester beer bottle and a manufacturing method for the same.

#### 2. Description of the Related Art

10 Currently used beer bottles are mostly glass bottles, which have a flanged top in bottleneck for covering and sealing with a cap. However, due to the fragility of the glass bottle, which is dangerous for the user, a plastic bottle is used to replace the glass bottle for filling beer. As is well known, as a bottle for filling effervescent beverages like beer etc, an excellent pressure-tightness is required. For example,  
15 Chinese Patent application CN971981515.5 discloses a zero oxygen seepage plastic bottle for beer and other use. This is a laminated plastic vessel having improved oxygen seepage resistance. It has a layer containing an oxygen scavenger. The structure and manufacturing process of this plastic beer bottle are both complicated. A specially assigned oligomer chain segment formulation should  
20 be required, thus the fabrication cost cannot be lowered.

It is also well known that the pressure-tightness of beer bottleneck is a key point to determining a pressure-tightness of the whole vessel. However the disclosed content in above-mentioned patent application does not describe to improved effectively the structure and pressure-tightness of beer bottleneck made  
25 by a plastic material and does not relate to whether any deformation would be occurred and is pressure-tightness for the bottleneck portion after sterilization processing at high-temperature such as 70°C (Pasteurize) is experienced for the bottle during a process for filling beer. In fact, the pressure-tightness for the bottleneck of plastic beer bottle already becomes an urgent key problem to be

solved, which directly affects the quality of filled beer, thereby it becomes the key problem for using the plastic bottle in filling beer.

### SUMMARY OF THE INVENTION

5 An object of the invention is to provide a crystallized bottleneck of polyester beer bottle, which would exhibit an excellent pressure-tightness and can hold an initial shape for the polyester beer bottle after sterilization processing at high-temperature is experienced for the bottle.

10 Another object of the invention is to provide a method for manufacturing a crystallized bottleneck of polyester beer bottle to keep an excellent pressure-tightness, after a sterilization processing at high-temperature is experienced for the bottle.

To realize above objects of the invention, the first aspect of the invention provides a crystallized bottleneck of polyester beer bottle, which has a crystallized  
15 length of 0.5-35mm through shaping bottle blank at high temperature. The crystallized bottleneck is no machined a screw thread.

Preferably, said crystallized bottleneck of polyester beer bottle installs a flange at its upside, there are a transition curved surface between the flange and a top plane of the bottleneck.

20 Preferably, a flanged ring is provided to said crystallized bottleneck of polyester beer bottle, said flanged ring has a plane bottom surface at a proper position spacing from the top flange of the bottleneck. An upper surface of the flanged ring is an acclivitous plane. The acclivitous plane forms an angle of 45° on vertical direction and converges to the outer surface of the bottleneck portion.

25 The second aspect of the invention provides a manufacturing method for a crystallized bottleneck of polyester beer bottle comprising the steps as follows:

a blank of a bottle made of polyester material is formed through drying, ejecting the polyester material and shaping it through cooling, then the uncrystallized blank of the bottle is placed for 24-72 hours in air-condition

environment;

a crystallizer is preheated two hours or more before a crystallization for the blank of the bottle is started;

a bunker is loaded with the uncrystallized blank, which is delivered to an blank  
5 horse's head via a conveyor belt, then a bottleneck portion of uncrystallized bottle blank is sent into a crystallizer to heat it at high temperature and crystallize it via an arbor transmission chain; at the same time, the uncrystallized portion of the blank body is controlled, so it is not effected by the environment at high temperature;

the polyester bottle blank having a crystallized bottleneck portion is  
10 discharged through output blank horse's head and delivered to another conveyor belt to cool and shape it.

Preferably, a cooling partition is used to realize that uncrystallized portion of the bottle body is not effected by an environment at high temperature.

For a person skilled in the relevant field of technology, it is easily understood  
15 that a polyester beer bottle having a crystallized bottleneck portion would be obtained, after the polyester bottle blank having a crystallized bottleneck is made with above-mentioned method and is placed for 24 hours, then further it is blown and shaped at heating up by means of blow-and-blow machines.

The crystallized bottleneck of the polyester beer bottle and the manufacturing  
20 method for the same provided by the invention effectively enhance the heat-durability of the bottleneck of the polyester beer bottle and stability for maintaining the dimension of it, so that the polyester beer bottle exhibits to an excellent pressure-tightness effect, and it is reliable for ensuring the quality of the beer received therein.

25

#### BRIET DESCRIPTION OF THE DRAWINGS

Through the detailed description for the embodiments incorporated with the attached drawings, the structure, features and advantages of the crystallized bottleneck of the polyester beer bottle of the invention will become more clear, and

the manufacturing method of the crystallized bottleneck of the polyester beer bottle will be further described, in which:

FIG.1 is a cross section view showing the crystallized bottleneck of polyester beer bottle in an embodiment of the invention;

5 FIG.2 shows schematically the crystallized bottleneck of polyester beer bottle in another embodiment of the invention;

FIG.3 is a schematic partially showing an arrangement of the device for crystallizing bottleneck of polyester beer bottle;

10 FIG.4 is a process flow diagram of an embodiment of the method manufacturing crystallized bottleneck of polyester beer bottle in the invention;

FIG.5 is a schematic of molecular structure of polyethylene terephthalate (PET) material before crystallized it;

FIG.6 is a schematic of molecular structure of PET material when the crystallization is started;

15 FIG.7 is a schematic of molecular structure of PET material after the PET material is crystallized at high temperature.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIG.1-3 now, the crystallized bottleneck of the polyester beer bottle of the invention is produced by heating and shaping the bottleneck portion at high temperature after uncrystallized blank is delivering to the crystallizer. The resulted crystallized bottleneck is no machined a screw thread. The crystallized bottleneck has a length L of 0.5-35mm, preferably 0.5-10mm.

25 As a preferably embodiment, an illustrative crystallized bottleneck of polyester beer bottle is produced with PET (polyethylene terephthalate) material.

As shown in FIG.1, this is a cross section view showing the crystallized bottleneck of polyester beer bottle in an embodiment of the invention. It can be seen, in this embodiment, the crystallized bottleneck of polyester beer bottle is provided a flanged ring 2 having a plane bottom surface at a proper position spacing from the

top flange 1 of the bottleneck.

As shown in FIG.2, it shows schematically a crystallized bottleneck of polyester beer bottle in another embodiment of the invention. It can be seen, in this embodiment, the crystallized bottleneck of polyester beer bottle is provided a flanged ring 2 having a plane bottom surface at a proper position spacing from the top flange 1 of the bottleneck. An upper surface of the flanged ring 2 is an acclivitous plane. The acclivitous plane forms an angle of  $45^\circ$  on vertical direction and converges to the outer surface of the bottleneck portion, as shown by a marker B in FIG.2.

As an embodiment, now a technological process for producing a crystallized bottleneck of polyester beer bottle will be described in detail incorporating with FIG.3 and FIG.4. In this embodiment, PET material is used.

#### Preparation

To ensure a sufficient crystallization, it is necessary that the uncrystallized blank of the bottle is placed for 24-72 hours in air-condition environment before a bottle blank is crystallized, then a crystallization process should be started.

On the other hand, it is also necessary that a crystallizer be preheated for two hours or more, before the crystallization for the blank of the bottle is started, so the temperature of the arbors and other parts in the crystallizer become uniform (see FIG.3), thereby an uniform crystallization for the bottleneck portion of PET bottle blank can be ensured.

It is showed in FIG.3, in this embodiment, the bottleneck portion of PET bottle blank 11 obtained by above processes is inserted to the arbor 12 of the sprocket wheel 15. At the same time, the crystallized region of the bottleneck is insulated by a cooling partition 13 so that the uncrystallized portion of the body is not effected by an environment at high temperature.

As a notice for the manufacturing process, the various components in the crystallizer should be kept clean, to prevent dust absorption of the bottle blank due to static electrification during the crystallization.

### Technological Process

After the uncrystallized blank is loaded into a bunker, the bunker is delivered to a blank horse's head via a conveyor belt, then a bottleneck portion of  
5 uncrystallized bottle blank is sent into a crystallizer to heat it at high temperature and crystallize it via an arbor transmission chain.

The polyester bottle blank having a crystallized bottleneck portion is discharged through output blank horse's head and delivered to another conveyor belt to cool and shape it. Finally, a beer bottle blank having a crystallized bottleneck  
10 would be obtained.

For a person skilled in the relevant field of technology, it is easily understood, after such bottle blank having a crystallized bottleneck is placed for 24 hours, then further it is blown and shaped at heating up by means of blow-and-blow machines, a PET beer bottle having a crystallized bottleneck would be obtained.  
15

### Technological Conditions

Before a bunker is loaded with the uncrystallized blank, the temperature of bottle blank is controlled by an arbor temperature controller and the temperature of bottle blank typically is controlled in a range of 120-150°C. After the uncrystallized  
20 bottleneck portion of the bottle blank is fed into the crystallizer, the temperature of the bottle blank is controlled by a bottleneck temperature controller and the temperature of the bottle blank typically is controlled in a range of 130-170°C. In crystallization, the crystallization temperature should be adjusted according to the operation speed of the crystallizer. Generally, the faster the operation speed of the  
25 crystallizer, the higher the required crystallization temperature. For example, when the operation speed for crystallizing the portion of the bottle blank is in a range of 7500-10,000 blanks per hour, i.e. the crystallization time required for each bottle blank is in a range of 90-120sec, corresponding crystallization temperature is in a range of 130-170°C.

During the bottle blank is crystallized in the crystallizer, in order to prevent a influence to the crystallization of the bottle blank by high temperature, the body portion of bottle blank is fallen under indirect cooling, while the cooling partition is cooled with cooling water and the temperature of cooling water is controlled in a range of 15-18°C. At the same time, said uncrystallized body portion of bottle blank is always outside of said crystallizer.

#### Analysis for Molecular Structure

Before and after crystallizing to the bottleneck portion of PET beer bottle, the arrangement for the molecular structure of PET material would exhibit obvious difference. The original molecular structure of PET material is an amorphous state in disorder under normal temperature, as showed in FIG.5. After a crystallization is implemented at high temperature, said molecular structure shall become regular and ordered, as showed in FIGs.6 and 7.

#### Comparison for the Performance Before and After Crystallization

The performance of PET bottleneck would exhibit obvious difference before and after crystallization. A comparison result is in the table 1:

Table 1

PET bottle blank before crystallization	PET bottle blank after crystallization
a transparent state (normal temperature)	non-transparent ivory-white
vitrification point: 67°C	vitrification point: 81°C
density: 1.33g/cm <sup>3</sup>	density: 1.455g/cm <sup>3</sup>
relatively poor mechanical behaviour	excellent mechanical behaviour
preferable extension at break	the higher crystallinity, the better the thermal stability
	harder hardness